ECO-BIOLOGICAL STUDY OF WILD BOAR (*SUS SCROFA CRISTATUS*) IN ISLAMABAD AREA, PAKISTAN

Irfan Ashraf*, Rashid Ahmad Khan, Shahid Yaqoob** and Asghar Ali***

ABSTRACT

A study was conducted to determine the biology of wild boar (*Sus scrofa cristatus*) in the Department of Forestry, Range Management and Wildlife, University of Agriculture, Faisalabad, Pakistan during the year 2009 and 2010. For this purpose, animals in Islamabad area were flushed out with the help of dogs and men for observation and capturing. Maximum number of animals were captured in January (35) and August (33) in the year 2009 and in March (37) and July (31) in 2010. The gut contents of autopsied animals were, more or less, same in all animals as the animals contained more cooked meat in their gut captured near populated areas of Islamabad while the animals captured from the natural areas contained more bark of trees and wild grasses. Litter size of captured females varied from 5-10/gestation and tusk size in males ranged from 5-11 cm. July and November were the active breeding months as autopsied animals contained more non-pregnant to pregnant female ratio i.e. 1:2.20 and 1:2.25, respectively. The reason for increase in population of wild boar is attributed not only to high litter size but also to availability of food, water and natural habitat in the study area.

KEYWORDS: Swine; *Sus scrofa Cristatus*; biology; reproduction; Islamabad; male/female ratio; population; Pakistan.

INTRODUCTION

Wild boar (*Sus scrofa*) is native to the European continent and lives freely in large number within a great diversity of habitats (24) and extended to Asia (3). The habitat includes swamp and marshland environments, mountains, coastal areas, deciduous and coniferous woodland, and can withstand extremely cold climates (27, 32). It was successfully introduced in dry, arid and tropical regions of Australia (12). The greatest food availability and protective cover especially in highly disturbed environments, enhance its adaptability (9, 16).

***Assistant Professor, Department of Forestry, Range and Wildlife Management.College of Agriculture, The Islamia University of Bahawalpur, **Department of Forestry, Range Management and Wildlife, ***Department of Agronomy, University of Agriculture, Faisalabad, Pakistan.**

Wild boar is found upto 915m elevation in the Margalla Hills, around Kahuta and Murree foothills, and throughout the Punjab and Sindh down to the Indus River mouth (27). Development of agriculture in Punjab and Sindh due to irrigation canal network provides a variety of suitable habitats for wild boars (6). Many studies have been conducted on feeding behavior of wild boar in previous decade which indicate that major portion of diet comprises plant material (28). However, Hafeez (19) determined higher amount of garbage content (58 %) in their diet.

Diet composition can help understand how animals use different habitats, to determine the ecological role of species, and their place within food webs (5). According to the optimal diet theory, individuals select their food to maximize their net rate of energy intake while foraging (30).

Adult of feral pigs has a 21-day estrus cycle and a gestation period of 112-114 days. Their breeding is limited by food availability and quality particularly the dietary requirement for about 15 percent protein (22). The litter size of feral pigs generally ranges 5 - 7 piglets, but may be as high as 10 under favourable conditions (10).

Wild boar is a serious threat to vegetation not only in hilly areas but also in urban areas of Islamabad. The present study was conducted to examine biology of wild boar and understand its feeding behaviour which could be helpful in checking its population in these areas.

MATERIALS AND METHODS

This study was conducted in the Department of Forestry, Range Management and Wildlife, University of Agriculture, Faisalabad, Pakistan during the year 2009 and 2010. Islamabad is located between 33.43°C north longitude and 73.04°C east latitude at the edge of Pothwar Plateau and in the foot of Margalla Hills at an altitude of 507 m (1,663 ft.) above sea level. The temperature of Islamabad ranges from a minimum of 3.9°C in January to a maximum of 46.1°C in June. The parameters included in this study were; total number of animals, litter size, average tusk size and active months of breeding. The areas selected for tapping were CDA Nursery, F9 Park, Faisal Mosque, Jasmine Garden, Prime Minister House, Quaid-e-Azam University and Rawal Lake. Three trap types were used to capture the animals for autopsy. The captured animals were autopsied for tusk size, gut contents, average litter size and pregnancy ratio. The stomach contents of the trapped animals were analyzed to study their food habits in the area. Stomachs of the trapped animals were immediately removed and sample of contents was

preserved in 10 percent formalin in a glass vessel. These contents were then washed with running water and sieved. After rinsing, the contents were placed on petri dish for micro analysis (35). From autopsied animals 50-100 ml sample of gut contents was taken into 70 percent alcohol for lab analysis (21). Ovaries were examined only for visible corpora lutea in earlier stages of the study. Periods of breeding and littering were determined by dating observation of development of secondary sexual characteristics, observing the occurrence of visible pregnancies in females and back dating ages of fetuses to determine dates of conception (25).

As Matschke (23) and Sweeney *et al.* (33) found eye lens to be of less value than tooth eruption as an age determination, eyes were collected from the killed animals and were fixed in 5 percent formalin for one month (31).

Tooth eruption is basically completed at 26-plus months in wild boar, so another method was used to determine age beyond this date. Incisor teeth were removed and sent to the Denver Wildlife Research Center, Denver, Colorado, USA, for sectioning and studying number of annular rings of dentine and cementum. This method has been used successfully in other ungulates (13). The tooth eruption method was used by Barrett (4) and Cabon (8).

RESULTS AND DISCUSSION

The data (Table 1) revealed that during the year 2009 maximum number of animals (n=35) were captured in the month of January against minimum number (n=13) in month of November (Table 1). Regarding male and female, maximum number of male population (n=17) was recorded during May while minimum population was recorded in December (n=5). Similarly maximum number of female population (n=22) was observed in January while minimum female population (n=4) was observed in November 2009. The pattern of population distribution is mainly based on availability of resources essential for daily life especially for vertebrates (1). Distribution pattern observed in month of October and November for wild boar showed almost similar pattern as observed in previous studies (11). It has earlier been reported that environment, and especially the temperature has a great impact on presence of an animal in the field, irrespective of cropped or non-cropped area (2).

Among autopsied animals, 65 percent of total captured female population was pregnant. Similar trend was earlier reported by Sweeny *et al.* (34). The litter size ranged from 5-9 per female, with a minimum litter size in the month

Table 1. Biology of trapped wild boars during the year 2009.

Month	Total mature animals captured	Male	Avg. tusk size (cm)	Female	No. of animals cut opened			Avg. litter size (No.)
					Male	Female		
						Total females	Pregnant	
Jan	35	13	7.61	22	05	03	03	6
Mar	28	16	6.35	12	03	01	01	7
May	31	17	10.16	14	05	02	02	5
June	16	11	7.62	05	02	01	01	9
July	19	08	8.89	11	06	02	00	-
Aug	33	16	5.0	17	04	03	01	7
Oct	31	13	5.59	18	03	04	03	8
Nov	13	09	8.13	04	02	01	00	-
Dec	16	05	10.16	11	01	01	02	9

of May and maximum during the months of June and December, 2009 (Table 1). The high rate of reproduction may be correlated with availability of ample food, nutritious forage and good place to live (15). The size of tusk ranged 5.59 -10.16 cm (Table 1).

Gut contents of wild boar included boiled maize, molasses, earth worms, tree bark, mud, green forage, fruits, cooked meat, wheat grains, chicken meat, remains of slaughter house waste, bread, garbage, animal tissues, leaves of grasses, weeds and unidentified plant parts. These results indicated that wild boar is an omnivorous animal feeding on a variety of food.

The data (Table 2) further showed that minimum male to female ratio was recorded in the month of December (1:0.45) while maximum (1:1.33) in the month of November. Similarly, mature/piglet ratio was minimum (1:2.82) in the month of October, while maximum (1:19.00) in the month of July. Non-pregnant and pregnant female ratios ranged from 1:2 (in October) to 1:16 (in August) (Table 2). A study conducted on the use of different habitat types by wild boar populations in French agro-ecosystem revealed that ratio of male to female in the study ranged from 1:0.45-1:1.3 (12).

Table 2. Male vs female, mature vs piglet and pregnant vs non-pregnant female's ratios in year 2009.

Month	M/F ratio	Mature/piglet ratio	Non-pregnant/pregnant female ratio
January	1:0.59	1:3.18	1:2.14
March	1:1.33	1:3.50	1:11.00
May	1:1.21	1:4.43	1:6.00
June	1:2.20	1:5.33	1:4.00
July	1:0.73	1:19.00	-
August	1:0.94	1:3.67	1:16.00
October	1:0.72	1:2.82	1:2.00
November	1:2.25	1:3.25	-
December	1:0.45	1:16.00	1:2.67

During the year 2010, maximum number of animals were captured in the month of March (n=37) while minimum number (n=10) was captured in August (Table 3). Maximum number of male population (n=21) was recorded in March while minimum population was recorded in February (n=1), October and November (n=4). Maximum number of female population (n=16) was also observed in March while minimum female population (03) was observed in February and August. The distribution pattern for number of male and female and average litter size is in accordance with the findings of Shafi and Khokar (29).

Table 3. Biology of trapped wild boars during the year 2009.

Month	Total mature animals captured	Male	Avg. tusk size (cm)	Female	Male	No. of animals cut opened		Avg. litter size (No.)
						Total females	Pregnant	
Jan	19	09	7.62	10	02	02	01	6
Feb	15	01	6.35	03	03	01	00	-
March	37	21	7.62	16	05	03	02	7
May	19	09	7.62	13	03	01	01	7
July	31	16	10.16	14	03	02	01	5
Aug	10	07	8.89	03	01	00	01	10
Sep	27	05	6.35	13	01	03	02	6
Oct	11	04	6.35	07	01	02	00	-
Nov	13	04	7.62	09	01	02	01	9
Dec	26	17	8.13	09	04	03	00	8

The female pig usually matures sexually at one year of age. Examination of reproductive rate of different age groups showed that they conceive at the age of 8-12 months. Among autopsied animals, 48 percent of female population was pregnant. The litter size in female ranged from 5-10 (Table 3). These results agree to those of Beg and Khan (5). Minimum litter size (n=5) was observed in the month of July, 2009 while maximum litter size (n=10) was observed in the month of August. The reproduction rate seemed to be correlated with availability of ample food, nutritious forage and suitable place for living. Nutrient availability greatly affects the population distribution pattern in an area. They act as first prime source of energy for various life activities. During pregnancy, animals had to eat more food to compensate for various body demands (32). Size of the tusk ranged from 6.35 cm - 10.16 cm during 2010 (Table 3). The size of tusk is an important parameter for age determination as indicated earlier (7).

Gut contents were almost same as were found during the year 2009. Generalised approach rather being specific in feeding increases the chances of survival in vertebrates (19). Diet composition of a wild boar is important to

determine food categories, item selection, seasonal variation, as well as to predict when and how some plant communities may be damaged (36). In addition, it is important both for conservation of a particular species by determining its specific requirements and for management of invasive species by predicting the effects of food consumption on the environment and on human concerns such as crop yields (5).

The results (Table 4) showed that male-female ratio ranged from 1:0.33-2.33. Minimum ratio was calculated in the month of February (1:0.33) while maximum (2.33) in the month of August. With regards to mature/piglet ratio, minimum ratio (1.86) was noted in the month of December while maximum ratio (1:11.00) was in the month of October. Non-pregnant and pregnant female ratios ranged from 1.15 (December) to 13.0 (July). As wild boar diet mostly comprises plant material, it relates to the season, and changes with change in season. The high content of plant material and the low percentage of animal matter in wild boar's diet have also been previously reported, (5) The major part of wild boar's diet during both seasons were herbs in wet season (45.2%) and in dry season (65.6%) followed by woody species as reported by Gerard and Campan (14).

Table 4. Male vs female, mature vs piglet and pregnant vs non-pregnant females' ratios in year 2010.

Month	M/F ratio	Mature/ piglet ratio	Non-pregnant/ pregnant female ratio
Jan	1:0.90	1:2.11	1:9.00
Feb	1:0.33	1:2.50	-
March	1:1.31	1:4.63	1:7.00
May	1:0.69	1:3.80	1:12.00
July	1:1.14	1:4.43	1:13.00
Aug	1:2.33	1:10.00	1:2.00
Sep	1:0.38	1:4.50	1:3.33
Oct	1:0.57	1:11.00	-
Nov	1:0.44	1:3.25	1:2.00
Dec	1:1.89	1:1.86	1:1.15

CONCLUSION

The results conclude that as the age of wild boar (female) increases, the litter size also increases. The average tusk size of wild boar was 7-10 cm. Month of August of the active period for reproduction of wild boar with average litter size of 5-11/female. As the diet of wild boar changes with the change in season, site modification according to environment could be beneficial aspect to control its population.

ACKNOWLEDGEMENT

The authors are thankful to Higher Education Commission, Islamabad for financial support for the project leading to Ph.D. Thanks are also due to Dr. Anwar Hussain Gill, Assistant Director Wildlife, Murree for providing technical support. Special thanks go to Dr. Tanveer Hussain, Chairman, Department of Forestry, Range Management and Wildlife Islamia University, Bahawalpur for his able guidance in writing this manuscript.

REFERENCES

1. Ahmad, E., J.E. Brooks, I. Hussain and M.H. Khan.1995. Reproduction in Eurasian wild boar in central Punjab, Pakistan. Acta Theriologica. 40: 163-173.
2. Ahmad, S.S. 2009. Ordination and classification of herbaceous vegetation in Margalla Hills, National Park, Islamabad, Pakistan. Biological Diversity and Conservation. 2:38-44.
3. Ashraf, I., T. Hussain, M. Jamil, I. Ahmad, M. Ahmad, G.H. Abbasi, M. Akram and M.A. S. Raza. 2012. Assessment of diversified vegetation community in Islamabad vicinity Pakistan. Russ. J. Agric. Soc. Eco. Sci. 12:37-40.
4. Barrett, R.H. 1978. The feral hog on the dye creek ranch, California: Hilgardia. 46:283-355.
5. Baubet, E., C. Bonenfant and S. Brandt. 2004. Diet of the wild boar in the French Alps. Galemys. 16:101-113.
6. Beg, M.A. and A.A. Khan. 1982. The wild boar in Pakistan. I. Istribution, habitat, and movement patterns. J. Anim. Sci. Pak. 4: 46-51.
7. Brooks, J.E., E. Ahmad, I. Hussain and M.H. Khan.1989. The agricultural importance of the wild boar (*Sus scrofa* L.) in Pakistan. Tropical Pest Mangt. 35: 278-281.
8. Cabon, K. 1959. Problem der alters bestimmung beim wildschwein, *Sus scrofa* nach der methode von Dub. Acta Theriol., 3: 113-120.
9. Caley, P. 1997. Movements, activity patterns and habitat use of feral pigs (*Sus scrofa*) in a tropical habitat. Wildl. Res. 21: 287-292.
10. Choquenot, D., J. McIlroy and T. Korn. 1996. Managing vertebrate pests: feral pigs. Bureau of Resource Sciences, Australian Government Publishing Service, Canberra.
11. Coblentz, B.E. and D.W. Baber. 1987. Biology and control of feral pigs on Isla Santiago, Galapagos, Equuador. J. Ap. Eco. 24:403-418.
12. Gabor, M., E.C. Hellgren, R.A.V.D. Bussche and N.J. Silvy. 1999. Demography, socio-spatial behaviour and genetics of feral pigs (*Sus scrofa*) in a semi-arid environment. J. Zool. 247:311-322.

13. Gasaway, W.C., D. Harkness and P.A. Rausch. 1978. Accuracy of moose age determinations from inisor cenmtum layers. J. Wildl. Manage. 12:558-563.
14. Gerard, J.F. and R. Campan.1988. Écoéthologique variability in the European wild boar comparison of French studies. Cahiers Ethol. Appl. 8:63-130.
15. Giles, J.R. 1980. The Ecology of the Feral Pig in Western New South Wales. Shed. Ph.D. Thesis, University of Sydney.
16. Goulding, M.J. 2003. An Investigation of Free Living Wild Boar (*Sus scrofa*) in Southern England. D. Phil Thesis. University of Sussex.
17. Green, R.E., A.P. Balmford, P.R. Crane, G.M. Mace, J.D. Reynolds and R.K. Turner. 2005. A framework for improved monitoring of biodiversity: responses to the world Summit on Sustainable Development. Conserv. Biol. 19:56-65.
18. Haber, A. 1966. The food of wild boar. J. Lowiec Pol.14: 2-3.
19. Hafeez, S. 2012. Food Habits, Feeding Seasonality and Assessment of Damage Inflicted by the Indian Crested Porcupine (*Hystrix indica*) in the Agro-forestry Systems of the Punjab, Pakistan. Ph.D. Thesis, Department of Forestry, University of Agriculture, Faisalabad.
20. Hafeez. S., M., Abbas, Z.H. Khan and E. Rehman. 2008. Preliminary analysis the diet of wild boar in Islamabad, Pakistan. Turk. J. Zool. 35(1): 115-119.
21. Kurnosov, K.M. and B.I. Petrischev. 1977. Embryogenesis of the wild boar, *Sus scrofa*. The state of external morphological characteristics in wild boar embryos in different stages of development. Zool. Zh. 56: 412-119.
22. Masters, K. 1979. Feral pigs in the south-west of Western Australia. Final report to Feral Pig Committee. Agricultural Protection Board and Department of Conservation and Land Management, Western Australia.
23. Matschke, G.H. 1963. Trapping and Handling European wild hogs. Proc. Ann. Conf. S.E. Assoc. Game Fish Comm. 16: 21-24.
24. Meriggi, A. and O. Sacchi.1992. Factors affecting damage by wild boar to cereal fields in northern Italy. Ongules/Ungulates. 91:439-441.
25. Petrischev, B.I. 1980. Linear weight growth in *Sus scrofa* embryos. Vest Vestn. Zool. 6:63-67.
26. Roberts, T.J. 1977. The Mammals of Pakistan. Ernest Benn, London.
27. Russo, L., G. Massei and P. Genov. 1997. Daily home range and activity of wild boar (*Sus scrofa*) in a mediterranean area free from hunting. Ethol. Eco and Evol. 9:287-294.
28. Schely, L. and T.J. Roper. 2003. Diet of wild boar (*Sus scrofa*) in Western Europe, with particular reference to consumption of agricultural crops. Mammal Review. 33: 43-56.

29. Shafi, M.M. and A.R. Khokhar.1986. Some observations on wild boar (*Sus scrofa* L.) and its control in sugarcane areas of Punjab, Pakistan. Bombay J. Nat. Hist. Soc. 83: 63-67.
30. Sih, A. and B. Christensen. 2001. Optimal diet theory: when does it work, and when and why does it fail? Anim Behav. 61:379-390.
31. Smiet, A.C., G.W. Fulk and S.B. Lathiya.1979. Wild boar ecology in Thatta district: a preliminary study. Pak. J. Zool. 1: 295-302.
32. Spitz, F. and G. Janeau.1995. Daily selection of habitat in wild boar (*Sus scrofa*). London J. Zool. 237: 423-434.
33. Sweeney, J.M., E.E. Provost and J.P. Sweeney. 1970. A comparison of eye lens weight and tooth eruption pattern in age determination of feral hogs (*Sus scrofa*). Proc. Ann. Conf. S. E. Assoc. Game Fish Comm. 241:285-291.
34. Sweeny, J.M., J.R. Sweeny and E.E. Provost. 1979. Reproductive biology of a feral hog population. J. Wild. Manage. 43:555-559.
35. Ward, A.L. 1970. Stomach content and fecal analysis: Method of forage identification. U.S. Dept. Agric. 1147: 146-158.
36. Wood, G.W. and D.N. Roark. 1980. Food habits of feral hogs in coastal South Carolina. J Wildl. Manag. 44:506–511.